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ABSTRACT

The organizational aspects of interdisciplinary research teams are discussed in terms of the way the following responsibilities are distributed over team members: assigning jobs, allocating resources, controlling communication, and evaluating the output of others. Suggestions are made for overcoming problems that arise from the inconsistent or indefinite assignment of responsibility in interdisciplinary teams. (MLH)

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INTERDISCIPLINARY RESEARCH TEAMS AS STATUS SYSTEMS

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Interdisciplinary research teams are social organizations. They share many of the problems of other types of organizations, but also have features that are peculiar to their objectives and their interdisciplinary constitution. In an effort to improve the productivity and creativity of interdisciplinary research teams, it is a sensible strategy to look both at the general organizational problems of these teams and also at those problems which are unique to interdisciplinary research. This report focuses on a general set of problems that are found in all forms of work organization. Although we will consider the special ways in which status systems operate in interdisciplinary teams, we want to emphasize that status problems are problems that interdisciplinary teams share with other kinds of organizations. We reserve for future consideration organizational problems that are specific to interdisciplinary teams.

The success of any work team in reaching a given objective depends upon coordination of the efforts of individuals. If a team is working efficiently, each team member is performing those tasks to which he is best suited. Each team member is given access to those resources he needs. Channels of communication exist which yield team members access to information or guidance needed to complete their tasks. Some mechanism for evaluation also exists, such that the output of each individual is monitored; thus if team members are not performing satisfactorily or if the team objectives change, members may be informed as to how their individual contributions need be changed to contribute more effectively to the group's objectives.

In most work teams, effective task performance depends upon effective communication. The status system of a team can promote or inhibit

communication. We mean by the status system of a team the way in which the following are distributed over team members: rights to assign jobs, allocate resources, control communication, and evaluate the output of others. Invariably these functions are unequally distributed among team members. Thus, some team members will have the right to make job assignments while others will not; some team members will be more influential in determining the manner in which resources are to be distributed, etc. The status system can enhance or diminish the effectiveness of the team through its effect on intrateam communication, that is, on which team members talk to one another and how they talk to one another.

In our society, the status system of many work teams follows bureaucratic or authority lines. The rights to assign jobs, allocate resources, control communication, and evaluate the output of others, are formally assigned to team members by some outside individual. This is typically the case in most modern work organizations. Individuals on an assembly line, for example, have very little right to determine how they are going to work, determine what resources will be available to them, very little rights of communication with others, and almost no rights of evaluation. This lack of rights is due to the bureaucratic structure, or the authority structure, which is imposed on the assembly line worker from above. In other work teams, the social organization of the team is not dictated to the same extent by the imposition of an authority or bureaucratic power system as it is by the relative status which each team member possesses.

It is important to recognize that a formal bureaucratic system is often a very effective means for organizing work. In contrast to our stereotypes of red tape and excessive rigidity, a formal bureaucratic structure can provide

a clear picture of duties and responsibilities in an organization. The military chain of command is perhaps the best example of the positive features of formal bureaucratic structure. Putting aside the fact that formal bureaucratic organization can be inappropriate to some kinds of tasks, it should be emphasized that when we refer to bureaucratic organization, we have in mind the positive features of clear lines of authority and clear specification of individual functions of team members.

Most interdisciplinary research teams do not organize themselves along bureaucratic lines. This is especially true when scientific colleagues get together to formulate an interdisciplinary project. In many interdisciplinary teams the lines of authority are not established by someone outside the team. Generally, if a group of individuals agree to work together on a given problem, coordinating their skills, they attempt to organize themselves into a system which facilitates efficient teamwork. By definition, a principal investigator who organizes an interdisciplinary team does not have a monopoly on the skills necessary for the team to function; neither does any other team member monopolize the skills. Under these circumstances it is highly unlikely that a bureaucratic model of organization would be appropriate, but there is still the problem of developing the team into an effective social organization.

Previous research in social psychology has demonstrated that if individuals are brought together to work on a team problem and are not provided with any means of social organization, they will organize themselves, generally along status or prestige lines. (Bales et al, 1951; Heinicke and Bales, 1953; Bales, 1953; Bales and Slater, 1955) That is, the status system of the team will follow the status system of the world outside the team; individuals whom other team members perceive as having high social status with respect to the outside world will be yielded the rights to assign jobs,

allocate resources, control communication, and evaluate the output of other team members.

In viewing scientific teams as status systems, we are attempting to evaluate how effectively the members of a scientific research team can organize themselves into a system which facilitates efficient teamwork. The relation between social organization of a work team and product efficiency of that team has been documented: Teams which possess clear social organization, that is, a very clearly defined decision-making and coordinating apparatus, tend to be more effective or produce a better product than teams which are not effectively socially organized. (Blau, 1955; Dornbusch and Scott, 1975) We can roughly define a socially effective organization as one which specifies each team member's role, the functions to be performed by that role, and the responsibilities of the role. For example, we would regard a football team as possessing an effective social organization; each team member's role in the overall play of the game is well understood by both that team member and his teammates. We view the status system of a scientific team as an important determinant of the effective organization of that team. We assert that a work team in which individuals possess a consistent set of statuses will also possess an effective social organization.

Each of the functions which we outlined above may be viewed as a dimension of status for individual team members; that is, individuals will have differential rights of job assignment, differential rights of resource control, differential rights to control communications, and differential rights of evaluation; and it would be possible to rank team members on any of these dimensions with respect to the rights that they possess. If the same individual who possesses a high degree of the right to assign jobs also possesses a high degree of the right to allocate resources, we may say that

he is "status consistent" with respect to these two dimensions. If, on the other hand, the person who possesses the right to assign jobs does not possess the right to allocate resources, we would term this individual "status inconsistent". Finally, if team members have no clear understanding of who possesses the right to assign jobs or the right to allocate resources, we term the team "status ambiguous" along these dimensions.

If we analyze the team in terms of the status or prestige possessed by various individuals along different dimensions, then the socially efficient or socially effective team would be the team which was status consistent. The socially inefficient or ineffective team would be the team which was either status inconsistent or status ambiguous. Status inconsistency or status ambiguity may stem from either of two sources. First, a team, or members of a team, may be status inconsistent or status ambiguous with respect to the internal dimensions of status. By internal dimensions we mean the dimensions defined by the coordinating functions necessary for effective operation of a team; that is, individuals may be inconsistent or ambiguous with respect to the rights to assign jobs, allocate resources, control communication, and evaluate the output of others. This may occur independently of the status or prestige that team members possess outside of the team. Secondly, discrepancy between internal status on any dimension and status in the outside world may be a source of status inconsistency or ambiguity.

As an example of internal status inconsistency and the problems it might cause, consider the following: In one team observed, team leadership was divided between a team leader who set goals for the team, decided the use of project resources, and evaluated job performances, and a team manager who oversaw day-to-day operation and coordinated report writing. Closest to the talents and progress of team members, the team manager had the responsibility

for assigning jobs to members. Because he did not evaluate job performances, however, his requests and assignments were viewed as secondarily important: team members jockeyed for task assignments that would result in positive evaluations from the team leader. Many team members behaved toward the manager as the team busybody. While he most often knew when progress was slowing from conflict over a piece of equipment which most team members needed, he could not ease the conflict by assigning priorities for use of the equipment. In fact, he was reluctant to assign tasks requiring that piece of equipment. Clearly the manager's lack of power to evaluate team members and to allocate resources created interactional problems for him with team members and contributed to team inefficiency. In short, this is a case where the team manager was status inconsistent because he had the right to assign tasks without accompanying rights to evaluate performances or allocate resources.

As another example of team inefficiency resulting from status inconsistency, we found in a team that we studied an engineer whose skills were unique among team members but who had no rights to initiate communication with other team members. He was responsible for purchasing or building equipment necessary for the team, yet had to wait for other members to initiate requests for equipment or for his services. As a result, he had no means of anticipating future needs for his services and could not make rational decisions about his own work priorities. In one instance, when faced with a high-priority request from the team leader, the engineer, having previously committed himself to another team member, could only respond, "You should have come yesterday." In this team, a person who had high resource control did not have the right to communicate with other team members or to exchange advice with them. Without such communication rights he did not have access to the information he needed to most efficiently distribute the resources over team members.

Intuitively it seems that people should know enough to create social organizations, or to socially organize their work teams, so that these sorts of inconsistencies do not occur. This is not always the case, particularly with respect to research teams. For example, the Manhattan Project, involving the construction of the first atomic bomb, was accomplished through the combined efforts of hundreds of scientists. Robert Oppenheimer was placed in charge of overall bomb assembly, while Edward Teller was responsible for one of the processes by which fissionable U-238 was separated from U-235. Oppenheimer and Teller theoretically held equal rights of task allocation and resource control in their areas of the project. In reality, however, General Leslie Groves held ultimate rights of resource control over the entire project, and Groves listened to Oppenheimer. Teller, to his chagrin, discovered that task allocations he had made to his scientists could not be completed because Oppenheimer didn't believe that Teller's separation process was potentially as efficient as competing alternatives, and had implied as much to Groves. Teller was thus placed in a position of status inconsistency with respect to rights of resource control and task allocation. Historians of the incident have interpreted it as a personality conflict between Teller and Oppenheimer. Analyzing the situation in status terms, however, we regard the problem as built into the system so that it would have occurred no matter who was involved.

Status inconsistency can often result in status ambiguity; that is, individual team members do not really know where they stand with respect to rights to allocate tasks to others, rights to control resources, rights to evaluate performance, etc. Status ambiguity, however, can result from other features of a team organization in addition to status inconsistency, and

therefore deserves to be looked at as a phenomenon apart from inconsistency. Consider, for example, a team all of whose members are competing for a scarce resource, where it is not clear who has the right to allocate that resource. In one case that we know of, secretarial services were a scarce resource, particularly as report deadlines approached. The situation was discussed in a team meeting, but the team leader did not exercise his allocation rights. Rather, he told the team members to decide among themselves who had priority for secretarial services. But the team members were unable to resolve the issue because each regarded his own report as highest priority. The situation was resolved arbitrarily; the team member who got there first had secretarial priority. It so happened that, in terms of the project goals, more important reports were sacrificed to less important ones simply on the basis of which was ready first. That ambiguity resulted in an implicit redefinition of project goals, since some important reports did not get typed in time for the deadline. In this team, higher status members were also doing more important tasks, so that a clear understanding of the status system would have resulted in greater team efficiency with respect to the team's goals. The team leader, however, sacrificed clarity by being democratic, and thereby created a situation of status ambiguity.

Thus far we have considered problems of the internal status system. These problems occur not only in interdisciplinary research teams but also in monodisciplinary teams, and generally in work organizations. They may occur even where there is a formal bureaucratic system. The technical specialist in the military is often in a status-inconsistent position. His expertise may not be brought to bear on a situation because he does not have the right to give orders.

The second source of status inconsistency or status ambiguity results from discrepancies between internal status and status or prestige possessed by individuals in the outside world. We will call status in the outside world, "external status". External-internal inconsistency is a problem to which interdisciplinary teams are particularly prone. Remember that most interdisciplinary teams do not organize themselves along bureaucratic lines, and thus team members must reach some common consensus about who possesses status rights. Previous research (Berger et al, 1972) has shown that the consensus reached about the internal distribution of status is generally dependent upon the distribution of external status among team members. Thus, we may define a condition of status inconsistency as existing any time the external status of a team member is different from the internal status accorded to him within the context of the work team. At first glance, we should expect that the distribution of external and internal statuses in most cases would be in line. But there are many empirical examples where external and internal statuses are inconsistent. There are many scientific teams where an extremely prestigious individual is brought on board to perform a specific function; he is not a permanent member of the team and is thus given a relatively low position in the team's permanent social organization. Or, consider the contrasting case where an individual with low prestige is brought onto a team because he possesses an extremely important skill, and is temporarily given high internal status. We believe that such external-internal inconsistency is a source of tension and discomfort for such individuals, and in turn may become a source of discomfort and tension for other team members. For example, the individual with high external prestige may not be able to work effectively on the team because he has no resource control; or other team members, who are much

higher than this individual in terms of internal status, may be somewhat shy in consulting with an individual of great external eminence. Thus, external-internal inconsistencies provide a second problem in the social organization of work teams.

In addition to such status inconsistencies, we expect the problem of status ambiguity to occur frequently in interdisciplinary scientific teams. The reasons for this are as follows: First, it is difficult in some cases for a group of individuals representing different disciplines to meet and to sort out the relative external status which each individual has brought into the group. For example, how does a chemist evaluate the prestige or the external status of an economist or a sociologist? Or, similarly, how does an economist or sociologist evaluate the external prestige of a mathematician? Thus, because individuals represent different disciplines, they may be status ambiguous with respect to the external status that each team member possesses. If they are status ambiguous with respect to external status, then external status cannot possibly serve as the basis for generating internal status in the team context. In addition, the internal status of individuals along the various control dimensions may easily become inconsistent, or may be ambiguous in a team representing many different disciplines. For example, consider the question of evaluation. Who has the rights to evaluate whom? The evaluation right assumes some competence or ability to accurately determine whether the work of some individual is appropriate, given the team problem. Yet consider an interdisciplinary work team attempting to predict the housing needs of this society in the year 2000. How does an economist go about evaluating the input of a sociologist to this problem? If the means of evaluation of output of individual members is not clear, then all team members will be status ambiguous with respect to this dimension.

We expect this sort of ambiguity to occur more frequently among members of interdisciplinary work teams because of the lack of common ground for evaluating work. Also, consider the problem of resource control. Given that a team has a limited amount of resources, for these resources to be effectively distributed, whoever possesses the rights to control and allocate resources must have some understanding of the real resource needs of the team members. In an interdisciplinary team, such understanding is very unlikely. Once again, is the chemist likely to understand the resource needs of the political scientist?

In sum, we expect problems of status inconsistency and status ambiguity to occur fairly frequently in scientific work teams. Given that status rather than formally assigned authority is the basis for the social organization of the team, we expect that these problems, the status problems, will seriously affect the team's product. Therefore, if one wants to organize an efficient scientific work team, one must take these problems of status inconsistency and status ambiguity into account and somehow resolve them.

In our current study, we are looking for the incidence of these problems and we examine teams to find how these problems are resolved. Some examples follow. First, we are currently investigating how the members of interdisciplinary research teams evaluate the external status which each member possesses. One dimension that teams could use to evaluate external status is simply the discipline represented by each member. If the disciplines themselves are differentially prestigeful, then we have every reason to assume that the prestige of a discipline may affect the prestige of an individual, and thus the external status of members of a scientific work team would be determined by the distribution of disciplines that they represent. For example, intuitively it is reasonable to assume that physical sciences, such

as chemistry or physics, are more prestigeful than social sciences, such as political science, psychology or sociology. If this is the case, then we might expect a team composed of chemists, physicists, sociologists, political scientists, and psychologists, to internally organize itself along such lines, or in such a fashion that physical scientists would eventually acquire the highest internal prestige in the team. Thus, the impact of the discipline an individual team member represents may have a very strong effect on his internal status.

Another means of organizing the internal status system of a multidisciplinary team is in terms of the relevance or importance of given disciplines to the problem at hand. For example, in bioengineering teams there are often problems for which the knowledge possessed by an engineer is of more immediate importance than the knowledge possessed by an M.D. In these situations we might expect the engineer to acquire higher internal team status than the physician. The interesting problem here occurs because M.D.'s generally have higher external status than engineers. Hence, both the physician and the engineer might feel status inconsistent working together on a problem where the engineer had the rights of control and coordination. Despite the fact that the task may require the engineer to have higher team status, the physician will have a difficult time overcoming his perception of the engineer as a mere technician. We are interested in discovering how teams resolve such status issues, or, indeed, if they can be resolved at all, so that such an interdisciplinary team may be effectively organized.

We see two means of resolving status conflicts and are interested in finding out how frequently, if at all, either means is utilized. First, potential status inconsistencies or status ambiguities may be at least

partially resolved by artificially imposing a bureaucratic authority system on the team in order to clear up ambiguities and eliminate internal inconsistencies. The imposition of such a bureaucratic system may itself cause tensions. Individual scientists are professionals with professional orientations and are notoriously resistant to operating in bureaucratic systems. This resistance alone could negate the positive consequences of bureaucratic organization. In addition, even if the team is bureaucratically organized such that team members are completely internally status consistent, this does not guarantee that there may not be external-internal inconsistencies felt by some team members.

A second approach which a team may utilize to solve its status problems involves the creation of a special team role. We call this role a "bridge role" and an individual who performs its functions a "bridge scientist". The bridge scientist, rather than reorganizing the status system of the team, attempts to "bleed off" the tensions which are generated by the status system. He may take responsibility for attempting to minimize status inconsistencies, or at least minimize their impact on the team. He seeks out problems of status ambiguity and attempts to clarify the relations between team members who may be status ambiguous. He may even try to explain the inevitability of internal inconsistencies along certain dimensions in the team. In other words, the bridge scientist narrows the gaps created by the status problems of the team.

A good example of necessity for, and function of the bridge scientist is illustrated by a situation in which no one performed such a role. We had a computer expert on a team who was assigned the responsibility of developing a programming language for all team computer work. In addition, he had the responsibility to write programs needed by individual team members. While

the programming language held the greatest long-term value to the team, each team member placed most importance on the program needed for his own work. Because of the importance of the programming language, the computer expert felt that he should have control over his own allocation of time; yet he did not feel he had sufficient status to resist the requests of other team members. Although personally very angry, he engaged in typical low-status behavior. With limited time, he tried to meet the continual urgent demands for programs while seeking to steal time to work on the programming language. There was no bridge scientist to clarify the importance of the programming language and to enhance the status of the computer expert, and to get team members to reduce their individual programming requests. As a result, anger, tension, and dissatisfaction over this problem continued, with the computer expert juggling priorities and accomplishing little.

Since we expect interdisciplinary research teams frequently to have status problems of the types we have outlined, we have hypothesized that teams in which some member (or members) performs this bridge role are less likely to suffer the effects of status problems, and therefore be more effective than teams in which the bridge role is absent. In some instances, the successful performance of the bridging role might simply require that one individual is able to induce all team members to accept the same standards of evaluation, or accept the same external standard for the determination of external prestige. In most cases, however, the exercise of the bridge role may be a much more complicated problem, the outlines of which we have only begun to explore.

In summary, we believe that work teams which are effectively socially organized will be more efficient and produce a better product. Secondly, we believe that the social organization of interdisciplinary research teams

generally occurs along prestige or status lines, rather than along formal bureaucratic lines. Third, because teams are generally socially organized along status lines, problems of status inconsistency and status ambiguity are likely to have a large impact on the quality of the work which a team produces. Fourth, we believe that interdisciplinary research teams are more prone to experience problems of status inconsistency and status ambiguity than are monodisciplinary research teams. Fifth, we believe that there are two means for resolving status problems when they occur: (1) reorganizing the status system of the team along bureaucratic lines, or (2) creation of a role of bridge scientist on the team. Our research is directed to locating status problems in interdisciplinary teams, and examining the ways in which teams cope with these problems. We are evaluating the success of different modes of resolving status inconsistency and status ambiguity. Finally, our goal is to find those modes which most enhance effectiveness, productivity, and creativity of interdisciplinary teams.

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